

Ann Arbor Collaboration Meeting Dec. 13-14 2002

Present: Yasuhiro Masuda, Kevin Coulter, Shelley Page, Greg Mitchell, Michael Dabaghian, Dharmin Desai, Gordon Jones, Michael Gericke, Pil-Neo Seo, Scott Wilburn, Geoff Greene, Mark Leuschner, Tim Chupp, Seppo Penttila, Bill Hersman

Regrets: David Bowman, Roger Carlini, Mike Snow, Todd Smith (Friday)

1. Master Schedule (Seppo)

- no time for mistakes!
- three main schedule components: beamline completion, arrival of equipment at LANL, installation and commissioning of apparatus

New schedule:

- must have monthly progress reports
- serious slippages go to exec. Comm..
- progress report to home page Gantt charts
- need a resource-loaded schedule for installation and commissioning

Changes:

- target is delayed one month. Now arrives in crates on May 1, 2003
- cave won't be ready (wired up) till May 23 due to 1 month needed for cave wiring; this delay is independent of anything to do with cave construction
- beam comes on July 1st; the month delay eats up one month of data taking for 2003; we now can expect 2 months of data in 2003 (Nov- Dec)
- won't know date for cave ready until end of January, when machine shops etc at LANL have assessed the job

How to track installation to avoid "interface problems" in the cave next summer? -> Seppo will work with work package managers.

Issue: Tom Ries to provide as-built 3d autocad for stand etc. We need to see where the coil supports are in relation to the main stand, ³He etc. Someone in the collaboration will have to take over at this point. We need a draftsman to do this? Absolute coordinate system has to be pegged to the cave floor; therefore we need someone at LANL to do this. LANL program is "unigraphics". Autocad won't talk to this. Would have to completely redo entry of all the drawings.

2. Beam Tests in January 03 (Seppo)

- January 15-22, 2003
- test of upper tier moderator performance.
- FP 14, 15 also looking at upper tier moderator. They have very tightly collimated flight paths. These guys are currently measuring 2-3 x less flux than expected. Nobody understands why. It could be that they have an alignment problem. (They have a water moderator, we have H₂) When we did the test in 2001, our flux on FP11a agreed with the simulations.

- little mini cave will be at 12 m. we can't put a collimator on the end. Won't have a flat top beam profile.
- Look at fast neutrons that have direct line of sight to moderator; fast neutrons are not guided. Need a substantial collimator for slow neutrons so that we know we are looking at the moderator and not some edge of the guide. Question: center line for guided and unguided neutrons should be the same. If it's not, we have an asymmetric beam and potential problems.
- will not have DAQ, will take data with digital scope for beam monitors, manual for beam scans. Need to send people to help – Des for beam monitors?

3. Guide Field: (Roger, on the phone)

- 4 coils are done, in storage at Berkeley
- Stuart/Roger in contact by email. Stuart will follow through. Case will consult. Stuart plus one or more students will come out and set up coils on floor. Don't know about the stand.
- Big power supply is at Berkeley and has been tested. Smaller correction coil supplies are at JLab.
- What's missing is a test of coils, measurement scheme, development of software controls. link to standalone pc.
- Biggest concern is scheme to move around probes in uniform and reproducible manner. Roger does not know if it has been done yet.
- Roger will come out for 3-4 weeks in May. Shelley summer student will help.

Question: need stand drawing to see how it will be assembled and bolted to the floor. Need this for the cave design. Seppo to tell Roger and Stuart how it is to be done and they will comply.

Question: has anybody looked to see now that the cave size is changed whether it will be out of the tuning range for the coil system? Answer: no, but send the dimensions and it can be done, Roger will arrange it.

Question: getting data out of local PC to the npdgamma DAQ Who's responsible? Stuart's student will be the contact person. Stuart's student is Bernard Lauss (Kevin got this from Tom Case by email) lauss@socrates.berkeley.edu. Apparently there is a meeting at Berkeley next Friday to go over the guide field stand. Kevin suggests somebody from this meeting participates at least by telephone.

Issue: where does initial attempt at field mapping get done – at Berkeley or at Los Alamos? Roger says “tell us when you want the stuff at Los Alamos and we will do it.” Installation schedule says June 6 for installation; Stuart will have it there sooner than that.

Question: reversal of field? Need to do the field map in two polarities. There has to be a spec. on how well it is reversed. Roger – same spec. as overall tolerances from DOE review.

4. Beam Monitors (Shelley)

- 3 new monitors exist; sent back to LND to have valves removed, will be tested in January
- installation is straightforward, will repeat quick test of all 3 early on in the cave
- main commissioning issue is calibrating transmission of target and ^3He systems as online diagnostic

Discussion:

- should the back monitor be thicker than 50% @ 4 meV? (can change ^3He gas proportion)
- how to deduce target ortho/para ratio? -> modeling needed. The system will be good for monitoring stability but it will not be so practical to come up with an absolute target composition with it.
- polarization of the transmitted beam is more sensitive to ortho/para fraction than transmission
- shielding needs to be designed, installed, optimized...

Homework/loose ends:

- 5 kV supply, cables, mounting the preamps, gain of preamps (Shelley and Scott)
- analysis routines, strategy for target diagnostics, analyzer cell (Shelley, Bill, Mark's monte carlo)
- mounting bracket for monitor 3 on the main stand (also for analyzer) (Shelley, TRIUMF)
- temporary stands for interim tests

5. Polarizer Status (Kevin)

- 1 cell at UM, the others at NIST
- lasers and optics at UM, 1 set in use
- NMR at UM since November
- long term test underway (3.5 weeks) , continuous monitoring -> issue? 2 occurrences of unexplained large and fast polarization losses. investigating loss of RF power during AFP?
- behind schedule as put to DOE, mainly due to oven
- **Oven** – coming up with Todd tomorrow; Kevin has been working with a temporary one that he built.
- **Stand** – need to fix final width and distance from RFSF. Oven will slide in and out on rails.
- **installation** schedule: 5 days installation and alignment @ 2 FTE (mid-August?)
- stand will have been assembled in the laser lab. Alignment of the frame and attachment to the floor may require additional time. (floor: 1" poly on top of the 1" steel floor)
- NMR requires 2 fiber optic passthroughs. Integration of the system with the magnetic field system still required.

Issues:

- engineering of cave pass through for oven is still required, plus safety issues. Will blow hot air in through a tube and then just let it diffuse in the area.
- total heat load in cave? How often will air be exchanged? (every 3 minutes) Will the cave heat up?
- will heating affect the photodiodes? What else will the temperature affect?
- procedure for getting safety approval? Seppo and Kevin will work together so that we can't get held up in red tape. Important to get the system early to LANL to get this process underway.
- patch panel for BNC's during diagnostic testing?
- preamp sits on the floor, will the 10 Gauss field hurt it? (saturate inductor? probably ok)

Commissioning:

- 2 days component check with monitors in place
- 5 days polarization check (need 3 days to get to 95% of equilibrium polarization)
- need a spec. on how much polarization we need for the RFSF tune up?

Issues:

- chlorine target installation – moving the oven in and out once a week is not something that Kevin is comfortable with. We need to look at how to do this. (later discussion – slide the Cl into the spin flipper after removing front plate of spin flipper?)
- absolute z locations of everything!
- when to send to Los Alamos? Working on it here versus at LANL, don't send too soon!
- how much contingency time should be included if polarization does not come up – what to do? (add a week of contingency time)
- open and close cave door – people running in and out – is the guide field sufficiently stable to work on this system?

Homework:

- Shelley and Kevin to figure out details of beam monitor calibration and analysis.

6. Analyzer: (Bill)

- Bill visited LANL in October and assessed existing components etc. – most major things are in hand
- remaining jobs are putting together, integration and commissioning
- cells: several on hand, have been shipped to UNH and polarized. Haven't measured polarization yet. Two thicknesses (thin/thick) exist. (5 and 10 cm long) (**Issue: Shelley needs a diagram!**)
- scenario: polarize in physics building, transport to experimental area either in permanent magnet case or with coils and a battery. NIST people use a solenoid. Put the cell in and then ramp the field down to take it out – recommended.
- polarization measurement: will duplicate the system for the polarizer cell, but will measure it in laser lab, not in the beam area.
- beamline fixtures: cell and aperture holder, position scanner needed (use smaller cell for this)
- simulation: neutron flux. Monitor signal? Determines length of measurement.
- polarization station: “exists” -> shipped to UNH but not assembled yet.
- Usage:
 1. mapping of spin flip efficiency (target out), performed once with xy scanner
 2. spot checks to verify performance, polarization through target.
- Schedule:
 - finalize plan by end of December
 - complete tests at UNH by end of February
 - deliver to LANL by March 15
 - Beam tests by end of September (?)

7. RFSF and Calibration Scheme: (Scott)

- discussion of where the CCl_4 target goes. In/out mechanically versus pumping liquid in and out?
Scott suggests to put it inside the RFSF next to the downstream window. Mark/Mike S. will make a prototype and test filling/ pumping it out.
- windows to be changed – decrease thickness and change downstream window to magnesium.
(Tradeoff between leaking out RF field versus absorbing neutrons in the aluminum.)
- improving the $1/t$ ramp via a feedback system to get a better ramp. Some hand-wired electronics needs to be packaged up, etc. new circuit – Q value is now a factor of two bigger than before.
- unfortunately the audio amplifier blew up. Can't buy a new one on the credit card due to financial scandals at LANL...
- Pil is going to do magnetic field measurements as soon as they are up and running again and will repeat leakage tests. Get significantly less than 1 mGauss for leakage fields already
- will run bench tests next to the CsI array to make sure no signal is picked up
- should also move it down the hall and make sure there is no effect on the ^3He
- agree on the size of the support plate in consultation with Tom Ries.

Beam tests:

- first have to tune for best spin flip efficiency. Adjust: t_0 , frequency to resonance of the circuit ($Q=80$), tune DC field in cave, amplitude of RF field
- then map the RFSF response

8. Stand Installation (Shelley)

- shipping all but RFSF shelf and cryostat support on Dec. 18
- 2 weeks in January – Tom Ries and Justin Ho to LANL to unpack and set up in ER2
- exercise controller, survey to check x-y motion
- move top half of stand to setup lab and mount detectors etc (1 month?)
- return top half, fully loaded to ER2 area, crane into place. Test fit with cryostat and exercise x-y controller under load with survey equipment (Manitoba technician to come for this)
- install large base plate in cave with bottom half of support stands – should mark template on the floor for installation of this plate
- survey and adjust to line up with center line in area.

Questions/issues:

- how much lateral adjustment with screws etc. is there for corrections in the area? (about 1")
- how much room between VPD and 2" intermediate plate for adjustment of feedback resistors in preamps?
- clearance between RFSF and target etc – summarize clearances.

9. LH2 Target (Mark, for Mike S.)

- target vessel – Al is designed
- vacuum vessel, Mg windows under construction
- 2nd cryorefrigerator not ordered yet.

- gas handling – designed, components ordered or in hand
- control system: PLC and accessories in house. Programming adapted from IUCF target

schedule: May 1, 2003 target and gas handling systems shipped to LANL in an assembled state (?)

issues:

- addition of Cl target. 3 cm thick. IU will prototype and check how well it can be pumped out.
- first cooldown will be done with Ti vessel, then open up and switch to Al. (do we really need to switch this? Question of a potentially large false asymmetry. Depends on how much beam we will have. Would have to do background and subtract.)
- need permanent on-site target experts. (Mike G., Seppo, plus one more?)
- two piece vessel we can open, or one piece? One piece was approved initially. Don't want to risk a hangup with the safety committee. Could make a 2 piece one later. But then we can't put the lithium shielding inside the vessel, which is a potential problem for the detectors. For one piece vessel, want to find a way of welding it with the ^6Li plastic inside.
- false asymmetry from aluminum? David has estimated about 1×10^{-9} asymmetry from 2 mm of Al. David thinks we should put a block of aluminum in and actually make a measurement of the background asymmetry. Issue: temperature dependence of polarization asymmetry from beta decay due to spin relaxation time. David prefers a two-piece which would enable us to put a piece of Al inside and measure with it cold.

Question: what diagnostic is there for the parahydrogen concentration? (various, but none at IU)

10. Neutron Shielding (Seppo)

- about 10% of the beam will scatter and may hit the crystals before they get to the target.
- how serious is the problem and what will we do about it?
- thin lithium plastic to line RFSF, target cell, around the analyzer and back monitor.
- how to shield the polarizer etc.
- probably have to put some more material around the outside of the CsI array.
- shielding fast neutrons is the trickiest part. ^3He system will be the biggest scatterer for these.
- Mike G. started using MCNP to see how many fast neutrons get to the crystals.
- we don't actually know what dose rate the crystals can take. (Bicron spec. sheet says 10 Gray)
.... Yasuhiro will put an old crystal in the beam and see when it dies.
- also, gamma rays will come out of the beam dump

Questions: CsI damage? Almost any energy of neutron will be captured. Need borated poly around the CsI array.

Question: How will we validate that we have enough shielding before we put the CsI in? Geoff – most of the fast neutrons have to come from the target itself. We probably just have to live with it. If we just have to live with it, why are we going to the bother of temporary stands for the RFSF etc? Why not just do the calculation and put the array in from day 1?

Issue: drill holes in Al face plate of CsI assembly and mount a borated poly 'wall' upstream of the CsI array...when it is at LANL, while the top half is apart for mounting crystals etc.

11. Electrical Systems

(Scott)

- have to make in-situ gain adjustments to feedback resistors.
- Scott and Michael will make “best guess” on the bench and then go and adjust when the beam is on (goal is 1% match; really have to do the final adjustments with beam)
- sum and difference amplifiers in progress
- clean and dirty power available in the cave
- engineers working on design of circuits outside the cave
- components being ordered very soon, so need to check that nothing is missing.
- standard 8 cycle spin sequence – we can define any arbitrary 16 step pattern with the sequencer unit

Issues:

- Are there any significant power requirements that Scott doesn't know about? Seppo: yes, the chopper vacuum pumps etc. need more 120V circuits. Or... anything in an odd location, or anything that requires anything other than a standard 120 V outlet, let Scott know!
- Is anyone bringing electrical equipment that is not “off the shelf” and certified; it needs to have a special safety inspection before it can be plugged in. Ditto for something standard that has been modified in some way.
- Need a block diagram of the electronics. Don't have anyone to do that yet.
- Everyone should take care that their cables will be long enough! May be different inside the cave as opposed to what has been used in test setups so far.

Question: Any concern about light in the cave? Answer, only problem would be the VPD's but they are well sealed. Red and Green led's on the front of the spin sequencer. Could that integrate to anything? (solution, turn off the display when we run)

12. Detector Commissioning

(Michael G.)

- Gantt chart – ready to install May 2003, consistent with Seppo's schedule
- by end of December:
 - assembly of VPD's, preamps and crystals
 - individual detector and VPD gain testing completed
 - gain matching of CsI to VPD's in progress (optimizing coupling between VPD and crystals)
 - detector stand completed at TRIUMF and shipped to LANL
 - need to test temperature sensitivity of VPD gains
- by end of March:
 - assembly of detector into stand and DAQ bench tests completed, with sum and diff. amps etc.

Discussion: Bottom plate supporting the whole stand has to be put in as the cave is built with nothing on it. Seppo's schedule shows this sometime in March. Then we have to reassemble the stand pieces in the cave.

13. DAQ and Analysis

(Greg)

- 3 VME crates running linux
- DAQ start/stop control panel
- PAW with C subroutines to analyze data after acquisition is stopped
- Data: 99% is from the fast ADC's
- Slow elements: B field, ^3He , x-y of stand, chopper – data from other PC's. need to talk.
- C code talks to the VME with some PERL for control. Writes data file
- C code to open data files, decode, and use CERN library (PAW, HBOOK) for histograms and plotting
- storage format... tape drive or big array of disks? Wait till the last minute and buy disks.
- summary info: run by run calculate A-gamma, counting statistics, monitor false asymmetries

Issue: Need a block diagram of signals and data structure!

- online analysis? Maybe we should just calculate the experimental asymmetry, not A-gamma? Need a policy on dissemination of preliminary results.

Suggestion: pursue electronic logbook option, as used for G0 and other experiments at JLab.

Advantages:

- thoroughly debugged and used by all experiments at JLab
- can probably get the software and some help via Roger
- more than one person can simultaneously have access to read/ write in the log book
- collaborators can read the logbook from anywhere, anytime – preparation for shifts etc.
- automatically logs all data runs and requires experimental conditions to be typed in before it will start a run – impossible to get the run numbers mixed up
- can search the data base on key words
- don't have to Xerox an old fashioned log book and distribute (with time delay) to institutions for analysis etc.
- can include a scanner, dedicated PC, so hand calculations and plots can be put in.

14. Chopper

(Mark)

- motor cooling issue?
- all electronics are home made. What do people want for readout etc?
- suggestion: record pulse by pulse time synchronization data, download to DAQ system
- what about motor temperature?
- need to have the ability to throw out a beam pulse if the chopper out of phase. Veto signal? Voltage signal for phase information- put that into an ADC. That would let us cut on the phase later.

15. Discussion of Installation and Commissioning Schedule –

to follow, separate notes.